



Australian Government

Department of Education, Employment and Workplace Relations

PMBPROD310C Produce injection moulded products

Revision Number: 1

PMBPROD310C Produce injection moulded products

Modification History

Not applicable.

Unit Descriptor

Unit descriptor

This competency covers the operation and adjustment of injection moulding processes and the solving of routine problems.

Application of the Unit

Application of this unit

This competency is typically performed by advanced operators applying knowledge of materials, product purpose and processes to the operation of injection moulding equipment to produce product conforming to requirements. It also requires using a range of well developed skills requiring some discretion and judgement to recognise and resolve a range of problems. The operator will:

- start up the injection moulding machine
- check settings and adjustments of equipment
- monitor equipment operation
- make appropriate adjustments to correct materials, equipment or process variations
- solve injection moulding equipment, material and process problems, seeking guidance where necessary or appropriate.

This unit does not include die setting - see *PMBPREP304C Set a die*.

Licensing/Regulatory Information

Not applicable.

Pre-Requisites

Prerequisites

This unit of competency has the prerequisite of *PMBPROD210B Operate injection moulding equipment*.

Employability Skills Information

Employability Skills

The required outcomes described in this unit contain applicable Employability Skills. The Employability Skills Summary of the qualification(s) in which this unit is packaged will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

ELEMENT	PERFORMANCE CRITERIA
Elements describe the essential outcomes of a unit of competency	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.

Elements and Performance Criteria

ELEMENT ELEMENT	PERFORMANCE CRITERIA Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
1. Plan own work requirements.	1.1 Identify the most appropriate equipment to be used for production and upstream and downstream operations from production plan or request. 1.2 Identify and check materials required, including additives and regrind and their amounts or percentages. 1.3 Implement measures to control identified hazards in line with procedures and duty of care. 1.4 Identify requirements for materials, quality, production and equipment checks.
2. Start up injection moulding process to procedures.	2.1 Identify process settings required for product. 2.2 Set process to required settings. 2.3 Check materials are correct. 2.4 Take appropriate action for non-conforming materials. 2.5 Set up date, batch and materials markings to specifications, as required. 2.6 Complete pre-start checks . 2.7 Start up injection moulding process.
3. Operate and make adjustments to the injection moulding process to procedures.	3.1 Operate injection moulding process, noting key variables. 3.2 Monitor controls/displays/terminals for production and process data. 3.3 Take samples as required and identify product out of specification. 3.4 Monitor product/process quality. 3.5 Make adjustments to remedy faults and nonconformity as required. 3.6 Establish a stable injection moulding process. 3.7 Adjust process to minimise scrap and trim. 3.8 Clean, adjust and lubricate equipment as required.
4. Shut down machine to procedures.	4.1 Determine type of shut down. 4.2 Select appropriate purging method. 4.3 Purge efficiently and adequately as required.

ELEMENT	PERFORMANCE CRITERIA
ELEMENT	Performance criteria describe the required performance needed to demonstrate achievement of the element. Assessment of performance is to be consistent with the evidence guide.
	4.4 Leave machine in appropriate condition and with appropriate locks, tags or notices. 4.5 Complete relevant documentation. 4.6 Ensure area is clean and clear after the shutdown, in readiness for the next start up.
5. Anticipate and solve problems.	5.1 Recognise a problem or a potential problem. 5.2 Determine problems needing priority action. 5.3 Refer problems outside area of responsibility to appropriate person, with possible causes. 5.4 Seek information and assistance as required to solve problems. 5.5 Solve problems within area of responsibility. 5.6 Follow through items initiated until final resolution has occurred.

Required Skills and Knowledge

This describes the essential skills and knowledge and their level required for this unit. Application of knowledge of the materials, equipment and process sufficient to recognise material and equipment conditions which may lead to out of specification production. For example, PVC easily shear heats and degrades when left too long at normal processing temperatures. Therefore particular care is needed when processing and purging PVC. Knowledge of organisation procedures, quality requirements at each production stage and relevant regulatory requirements along with the ability to implement them within appropriate time constraints and work standards.

Application of the knowledge of managing risks using the hierarchy of controls applied to the injection moulding process. Application of approved hazard control and safety procedures and the use of PPE in relation to handling materials, equipment operation and cleanup.

Skill to identify the range of possible causes of product faults.

Knowledge as a basis for solving processing and material problems, including:

- characteristics of materials and behaviour in relation to heat, pressure, flow rate and time
- function and operating principles of injection moulding equipment, machine components and ancillary equipment, including the mechanical, hydraulic, pneumatic, electrical and electronic principles which effect machine operation
- impact of machine speed, temperature, pressure, time during cycles on product quality and production output
- phases of the injection moulding cycle and the effect of the key variables on product quality, in order to make appropriate adjustments to machine settings. For example, the packing phase is needed to compensate for the polymer shrinkage, inadequate packing pressure may cause voids, but excessive packing pressure may cause excessive residual stresses and or flash.
- processing behaviour of those polymers which are moulded at the workplace
- changes to materials at various stages of production
- waste management and importance of non-conforming materials
- impact of variations in raw materials and equipment operation in relation to final product
- polymer properties and their interactions with process conditions
- relationships between polymer properties and process conditions
- changes to polymer properties to better suit process requirements
- product problems related to polymer properties
- product problems related to process conditions
- adjustments to process conditions to meet polymer and product requirements.

Competence also includes the ability to:

- plan own work, including predicting consequences and identifying improvements
- maintain output and product quality using appropriate instruments, controls, test information and readings
- identify and describe own role and role of others involved directly in the injection moulding process
- identify factors which may affect product quality or production output and appropriate remedies
- identify when the when assistance is required to solve problems.

Language, literacy and numeracy requirements

This unit requires the ability to read and interpret typical product specifications, job sheets and complex machine control panels such as those displaying SPC information.

Writing is required to the level of completing workplace forms, quality assurance records and production reports.

Numeracy is required. For example, to determine that for a machine producing components weighing 100grams each at the rate of 2000 components per hour the output would be 200kg/hr. If 10% regrind is being blended, then 20kg/hr of supply is needed.

Evidence Guide

The Evidence Guide provides advice on assessment and must be read in conjunction with the performance criteria, required skills and knowledge, the range statement and the assessment guidelines for this training package.

Overview of assessment

A holistic approach should be taken to the assessment.

Assessors must be satisfied that the person can consistently perform the unit as a whole, as defined by the Elements, Performance Criteria and skills and knowledge.

Where the assessee does not currently possess evidence of competency in *PMBPROD210 Operate injection moulding equipment*, it may be co-assessed with this unit.

Critical aspects for assessment and evidence required to demonstrate competency in this unit

It is essential that competence is demonstrated in the knowledge and skills defined in this unit. These may include the ability to:

- identify critical materials properties and injection moulding process variables in relation to the process requirements and the end product
- make adjustments to the process as required
- identify and take appropriate action on problems and potential problems.

Consistent performance should be demonstrated. For example, look to see that:

- the process runs consistently and smoothly, with the minimum need for human intervention
- all safety procedures are always followed.

Assessment method and context

Assessment will occur on an industrial injection moulding machine(s) equipment and will be undertaken in a work-like environment.

Competence in this unit may be assessed:

- by using an appropriate, industrial injection moulding machine requiring demonstration of start up, operation and shut down procedures
- in a situation allowing for the generation of evidence of the ability to respond to problems
 - by using a suitable simulation and/or a range of case studies/scenarios
 - through a combination of these techniques.

In all cases it is expected that practical assessment will be combined with targeted questioning to assess the underpinning knowledge and theoretical assessment will be combined with appropriate practical/simulation or similar assessment. Assessors need to be aware of any cultural issues that may affect responses to questions.

Assessment processes and techniques must be culturally appropriate and appropriate to the oracy, language and literacy capacity of the assessee and the work being performed.

Specific resources for assessment

This section should be read in conjunction with the Range Statement for this unit of competency. Resources required include suitable access to an operating plant or equipment that allows for appropriate and realistic simulation. A bank of case studies/scenarios and questions will also be required to the extent that they form part of the assessment method. Questioning may take place either in the workplace, or in an adjacent, quiet facility such as an office or lunchroom. No other special resources are required.

Access must be provided to appropriate learning and/or assessment support when required. Where applicable, physical resources should include equipment modified for people with disabilities.

Range Statement

RANGE STATEMENT

The range statement relates to the unit of competency as a whole. It allows for different work environments and situations that may affect performance. Add any essential operating conditions that may be present with training and assessment depending on the work situation, needs of the candidate, accessibility of the item, and local industry and regional contexts. Where reference is made to industry codes of practice, and/or Australian/international standards, the latest version must be used.

Context

This competency applies to all injection moulding within the plastics and rubber industries. It includes the operation of all relevant additional equipment where that equipment is integral to the injection moulding process.

Procedures

All operations are performed in accordance with procedures.

Procedures include all relevant workplace procedures, work instructions, temporary instructions and relevant industry and government codes and standards.

Tools and equipment

This competency includes use of equipment and tools such as:

- injection moulding machines (eg electrical, pneumatic, mechanical, electromechanical and hydraulic)
- components of injection moulding machines (eg base, frame, feed hoppers and material supply mechanisms, barrel and screw plastification unit, injection units)
- die/tool (eg pneumatic, or hydraulic actuation of cores, slides ejector systems)
- additional equipment (eg chillers, die heating equipment, hopper driers, mixing hoppers, dehumidifying driers, air compressors, dosing machines, colour blending equipment and conveyors where they are integral to the operation of the injection moulder)
- hand tools used in the injection moulding process
- material loading equipment used for loading of raw materials
- relevant personal protective equipment.

Hazards

Typical hazards include:

- spills
- dusts/vapours
- slip and fall (such as due to spilt granules)
- temperature (eg due to heated barrel, nozzle and hot runner moulds)
- hazardous materials (including decomposing polymer during start up and shut down)
- moving equipment (eg moving moulds, robots and ancillary equipment)
- manual handling hazards
- equipment operations.

Problems

'Anticipate and solve problems' means resolve a wide range of routine and non-routine problems, using product and process knowledge to develop solutions to problems which do not have a known solution/a solution recorded in the procedures.

Typical routine faults include:

- short mouldings
- flash
- sink marks
- voids
- burn marks
- splay/splash marks/silver streaking
- blistering
- flow marks
- poor surface finish
- weld lines
- poor colour dispersion
- colour contamination
- black spots
- ejection damage.

Non-routine faults, which may have multiple causes include:

- release problems
- distortion of product upon ejection
- warping or cracking after moulding
- residual stresses
- intermittent faults.

Typical process and product problems may include:

- die/tooling problems, eg damage
- equipment malfunction
- variations in temperatures, pressures, speeds, times, and cushion position
- variations in material properties and/or contamination of materials
- variation in material flow rates
- processing problems.

Appropriate action for problems outside of area of responsibility may be reporting to an appropriate person.

Appropriate action for solving problems within area of responsibility includes asking questions and seeking assistance from appropriate persons/sources.

Variables

Key variables to be monitored include:

- differences between actual and set temperatures
- speeds (including injection speed, mould opening and closing speed and ejection speed)
- hunt or sprue break positions
- colour and uniformity
- surface finish/appearance
- tolerance for cushion position
- times (including injection times and cycle time)
- product weight and output rate
- product integrity and general conformance to specification and quality sample.
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Unit Sector(s)

Not applicable.